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ABSTRACT

First in an education and work series on innovative vocational training programs in Asian countries, this booklet describes the program in Singapore of integrating technical studies with general education at the lower secondary level through centralized workshops that provide training for students from all types of secondary schools in a region. The program description is presented in five sections: (1) background of the system, (2) centralized workshop scheme, (3) curriculum arrangements, (4) staffing matters, and (5) achievements of the system. One-third of the thirty-two-page manual is comprised of an appendix which includes samples of the following: syllabus on electricity; instructional sheets or handouts (electrical); teaching guide for metalwork teachers; project sheet; operations sequence sheet; marking scheme; and theory test for electricity. (BL)

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Centralized Workshops in Singapore

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Study prepared for the Asian Centre of Educational Innovation for Development (ACEID)

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The Asian Programme of Educational Innovation for Development (APEID), initiated on the recommendation of the Third Regional Conference of Ministers of Education and Those Responsible for Economic Planning in Asia (May-June 1971, Singapore) and the authorization of the General Conference of Unesco at its seventeenth session (Paris, 1972), aims at stimulating and encouraging educational innovations linked to the problems of national development in the Asian region.

All projects and activities within the framework of APEID are designed, developed and implemented co-operatively by the participating Member States through their national centres which have been associated by them for this purpose with APEID.

The Asian Centre of Educational Innovation for Development (ACEID) has been established at the Unesco Regional Office for Education in Asia (Bangkok) to co-ordinate the activities under APEID and to assist the associated national institutions in carrying them out.

The main objectives of APEID are:

- to promote awareness of the need for educational innovation;
- to promote understanding of innovative practices, and to encourage experimentation and adoption of educational innovations;
- to help strengthen national capabilities for the creation and use of educational innovations;
- to identify and stimulate innovative activities and co-operative action among Member States; and
- to promote the transfer of experiences.

Preface

An emerging trend in education in many countries in Asia is reflected in the search by national authorities for appropriate ways to inter-link learning in the school with genuine work experiences. There is a growing recognition that the isolation of the school from the everyday world of work has deprived education of a resource which is important both for the personal growth of educands and for the contribution that education has to make to national development.

The Asian Centre of Educational Innovation for Development is therefore preparing, in collaboration with educators of the region, a series of short studies which describe some of the experiments underway in the countries in Asia for linking education and work. The purpose of these studies is to assemble the records of practical experiences generated in projects with broadly similar objectives but which function in a wide variety of conditions and in different countries.

The present publication is the first one in the series 'Education and Work' and describes the programme in Singapore of integrating technical studies with general education at the lower secondary level of the school system and the working of the centralized workshops. The programme has been in operation for nearly five years and thus lends itself to some judgement regarding its outcomes and effects.

The author, Mr. P. Harbans Singh, is working as School Adviser/Technical in the Ministry of Education,

Government of Singapore. The Asian Centre of Educational Innovation for Development wishes to record its thanks to Mr. Harbans Singh for contributing this study. The views expressed herein are those of the author and do not necessarily represent the views of Unesco or of the Government of Singapore.

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1. Background of the system

> *Singapore is undergoing social and economic transformation ... With more than half of its population under the age of twenty-one and with manpower as its most valuable natural resource, education is necessarily part of this process of rapid change. The aims and content of education are being reorientated to evolve an educational system which will support and develop the Republic as a modern industrial nation with a cohesive multi-racial society... The seventies will see the qualitative improvement of education as well as the evolution of a sound educational system with a strong technical education component.*
>
> (from the Foreword to *Education in Singapore*, 1969)

Although the educational policy in Singapore, since 1959, had laid stress on technical education and industrial training as the only possible solution to meet the manpower requirements of industrialization, the secondary system of schooling existing in 1968 was still strongly biased towards academic education.[1] For example, only six per cent or 1,382 out of 25,187 school leavers at the end of 1967 had received technical education. This situation was not in harmony with the Government's policy on industrialization.

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1. *Education in Singapore*, p. 5.

The economic implications of the British decision to withdraw military forces by 1971 also necessitated in part the acceleration of the industrialization programme, which resulted in the setting up in April 1968 of the National Industrial Training Council (NITC) to increase training facilities and build up technical education. A separate Technical Education Department was established in the Ministry of Education to administer technical education and the industrial training programmes. The NITC, consisting of the Minister for Education as Chairman, and the Minister for Finance, the Minister for Labour and the Parliamentary Secretary (Education) as members, was responsible for the formation of general policy relating to technical education and industrial training in Singapore.[2]

One of the first tasks undertaken by the Council was to reform the educational system, with heavy emphasis on technical studies. In the initial two years of secondary education, almost three-quarters of the pupils, in addition to studying general subjects, were to study technical subjects outside their normal school hours. The aim was to eventually have one-third of the pupils in the technical stream and the remainder in the academic stream, stage-by-stage.

Implementation of the above reforms resulted in a tremendous increase in the number of pupils who had to be given instruction in technical subjects; i.e., from 7,504 in 1968 to 36,175 in 1969 and 59,232 in 1970.[3] This necessitated the modification of the workshops in the existing schools and provision of new workshops. These new workshops came to be known as the Centralized Workshops.

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2. *One year of technical education 1968-1969.* p. 4.

3. Technical Education Department. *Third annual report 1970-1971.* p. 5.

2. Centralized workshop scheme

> *Plans for the development of the Multi-purpose Schools were shelved because of financial restrictions and other considerations. To maximize the use of facilities in such schools, the Technical Education Department has reorganized the workshops as part of the centralized workshop system.*[1]

The centralized workshop system was the outcome of the Republic's policy of giving the secondary school framework a "strong technical component". This was to be achieved within the limited resources available. Prior to this change in 1969, there were four types of secondary schools in Singapore--academic, multi-purpose, technical and vocational. The last three types of school were almost like academic schools except that a few technical subjects were included in their curriculum. The vocational schools were not very popular because they admitted only pupils who had failed to gain admission to the other types of secondary schools.

Moreover, as parental preference determined the type of education a child received and there was a general prejudice against technical studies, enrolments in schools with technical classes tended to be very small. Centralized units of workshops helped to encourage a more favourable attitude to giving practical instruction to Secondary One and Secondary Two pupils while they continued to remain in the academic schools of their choice.

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1. *One year of technical education, 1968-1969*, Cmd. 29 of 1969. Singapore, Ministry of Education, 1969.

Centralized Workshops were so located geographically that each could provide training facilities to serve the academic schools of a particular region and within easy distance for pupils of that area. Special attention was also given to the bus routes available for these pupils when allocating their schools to a centralized workshop in that area. Instructional periods were limited to a three-hour session once a week.

The centralized workshops function in the morning from 8:00-11:30 and in the afternoon from 14:30-18:00, to fit in with the secondary school afternoon sessions of 13:05-18:30 hours and morning sessions of 07:35-13:00 hours, respectively. This arrangement provides opportunities to the pupils to attend their workshop practice outside normal school working hours. Slight adjustments are permitted to suit local times and requirements of the schools of a particular area.

The cost of establishing each new workshop unit, in 1969, was in the region of S$400,000 for building and S$150,000 for furniture and equipment. Sufficient equipment has been supplied to the centralized workshop units to enable them to provide basic courses in metalwork (bench fitting and tin-plate work), woodwork and electricity. Technical drawing rooms are located in the academic schools served by these workshops. Each centralized workshop unit is provided with 4 metal workshops, 2 wood workshops and 2 electrical workshops, a store, an office-cum-staff room and toilet facilities to cater for a maximum of 80 mixed classes or 3,200 boys and girls in both morning and afternoon sessions. Larger units providing for the needs of 120 classes or 4,800 pupils have one and one-half times the facilities (teaching rates, furniture and equipment) of a single workshop unit, mentioned above.

Several workshops constitute a group or administrative unit under the charge of a supervisor. Assisting him are a senior assistant, senior subject teachers

and teachers. As most of the centralized workshops are located within the precincts of existing schools, security arrangements are shared with them.

All centralized workshop units fall within the jurisdiction of the Ministry of Education. Supervision is exercised over them through a corps of school advisers under the direction of the Deputy Director (Schools) assisted by his Assistant Director (Secondary) from the Ministry of Education headquarters. Presently, there are 15 centralized units of workshops located all about the island of Singapore with the capability of handling a total of 1,360 classes, or 54,400 pupils. These workshop facilities are adequate to the requirements as envisaged for the present or the near future.

Government funds are provided for tools and materials supplied to the pupils. Practical jobs or projects when completed belong to the pupils and may be taken away. For the theory lessons, pupils may provide their own notebooks if they wish, but information sheets are supplied to them for each lesson. Pupils must attend workshop practice in their school uniforms and wearing an apron. The apron helps to protect their clothes and gives them confidence in work. The discipline of work is enforced in the workshops and observance of general safety rules is stressed at all times. The objective is to create a genuine environment of work.

3. Curriculum arrangements

> *Radical changes have also been introduced in the secondary curriculum since 1969 ... Consequently, a common curriculum for the first two years of secondary school was introduced in 1969. Under the common curriculum, besides the normal school subjects, all boys and 50 per cent of the girls are required to study technical drawing and workshop subjects; viz., metalwork, woodwork and basic electricity. The remaining 50 per cent of the girls ... take home economics instead.*[1]

Sometime during the mid-1950s it was realized that a large number of secondary pupils should be encouraged to study technical subjects as an important step towards meeting the acute shortage of technical manpower in Singapore—but it took more than a decade to bring about any radical change in the educational policy to achieve this effectively. Prior to the educational reforms, pupils from the very first year of their secondary education followed either an academic, technical, commercial or vocational programme. Although, in theory, it was possible for pupils to change courses during their secondary education, this seldom occurred in actual practice. By 1968, this resulted in 92.4% of the fourth-year pupils in secondary school being in the academic stream (27,007 out of a total of 29,237).

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1. Ministry of Education. *Education in Singapore, 1972.* p. 22

The educational reforms postulated in 1969 required all boys and 50 per cent of the girls in their initial two years of secondary schooling to study technical subjects "to provide a more liberal education and to avoid narrow specialization and rigid streaming". The postponement of specialization until the end of the second year besides being more "in line with the latest trends in educational theory and practice"[2] was found more desirable for the all-round development of the pupil and in keeping with the changing social and economic patterns in Singapore.

Under the new curriculum, all secondary pupils follow a common course during the first two years of their schooling. The purpose of the new arrangement is to enable the pupils "to acquire literacy, numerical skills and ability to deal with concepts" besides being introduced to basic manual skills through organized workshop practice. In this way it was hoped to realize the objectives of allowing the secondary pupils to receive a more liberal general education and to influence them to consider a wider range of jobs on completion of their school career. Moreover, since there was a tendency among school leavers to avoid being involved in manual occupations it was envisaged that exposure to practical work may develop in them a positive attitude toward work, and good working habits which will continue during their lifetime.

Education in technical subjects within the school system now commences at the beginning of the first year is secondary education. Practical instruction is provided in three subjects—metalworking, woodworking and electricity—with 1½ hours weekly for metalworking and 1½ hours in alternate weeks for woodworking and electricity. In addition, all pupils included under this scheme are taught technical drawing for two 40-minute periods a week as a classroom subject in the

2. *One year of technical education 1968-1969.* p. 5

academic schools. Since the instruction in the workshop subjects is given outside normal school hours, attendance at the centralized workshops does not interfere with the teaching of the usual academic subjects in the school.

At the lower secondary level, technical education aims at exposing pupils to practical work experiences in several workshop areas, acquainting them with the basic skills involving the use of hand tools and simple machines and giving them some theory related to their school workshop experience as well as introducing them to the rudiments of technical drawing.

During the practical sessions, pupils are given carefully graded tasks for making attractive and useful things. Discussing, planning, and solving the problems of construction, forming or shaping give them an opportunity to engage in processes which are closely linked with daily life. Checking of tools before and after each session and taking a share in keeping the work areas clean and well-ordered are means of inculcating in the pupils a responsible attitude towards safe and correct work habits.

Technical studies in the school situation are not intended to provide vocational training; rather they are designed to help the children to understand, through actual work, those processes which underlie their rapidly changing environment.

The effectiveness of the curriculum depends upon the thoroughness with which its content is taught. To help the academic teachers who had been retrained at short notice to face the task ahead of them, fairly detailed teaching materials and syllabuses had to be prepared to assist them in achieving some uniformity in their standard of instruction. Due to a lack of suitable textbooks, and to save parents from being saddled with the additional burden of purchasing books for four technical subjects, no textbooks are suggested

for use by pupils. Teachers are actively encouraged and guided to prepare their own information sheets or handouts for issue to the pupils free of charge.

Teaching guides elaborating upon the teaching and learning objectives of the syllabus and suggesting ways to make lessons or workshop sessions more effective are provided to the teachers. In this way, it is hoped to achieve a more uniform treatment of the technical topics and the practical situations covered by these topics. Teachers are, of course, encouraged to try out other approaches to make the instructional process more effective.

Practical project sheets are carefully made, bearing in mind the operational sequence in which the skills are to be introduced to ensure that the work given to the pupils is useful and interesting from the educational viewpoint.

Keeping in step with recent developments in the field of education and training, and realizing the strong points in favour of continuous assessment or evaluation of pupil performance, it was decided to abolish practical examinations in the workshop subjects. Instead, a marking scheme which takes into account the pupils' daily performance was introduced and has been in use for some time. It is by no means perfect but it is providing more reliable information on the pupils' progress than was formerly obtained. Theory tests are also regularly administered to gauge the pupils' grasp of the technology related to the practical aspects of the work done by them in the school workshop.

Frequency distribution studies are made of the pupils' achievements to measure the pupils' achievements in the technical skills. These workshop grades are provided to the schools by the centralized workshops and are entered in the pupils report books forming an important criterion for channelling of pupils into the technical stream at the higher secondary level.

A wide range of modern educational aids and equipment, such as overhead projectors, transparency makers, slide projectors, loop-film projectors and electronic scanners are being used in the centralized workshops to make both the teaching situation and the learning process more effective and stimulating.

The conditions in the centralized workshops are, generally speaking, satisfactory but more can be done to encourage teachers to meet, on their own, to discuss their teaching problems and to co-ordinate their efforts. Professional officers from the Ministry of Education have, in the past, held several meetings with them to elaborate and elucidate the syllabuses, teaching guides, project sheets, operational sequences and the assessment schemes. Their role is to motivate teachers to open a dialogue with other practitioners on matters of mutual interest.

On completion of their lower secondary education at the end of Secondary Two, pupils may be channelled to higher Secondary Three and later Secondary Four in the arts, science, commercial and technical streams or leave the secondary schools to join vocational institutes which provide courses in industrial training which lead to the award of the Trade Certificate.

At the beginning, due to prejudice against manual work, a small number of pupils and parents displayed an open dislike for workshop practice. This, in fact, if properly investigated, could also be true of several other subjects in the school curriculum. It is the teacher who, ultimately, makes his subject interesting to his pupils. With good teachers, the opposition to workshop practice has declined. Those who really prove unsuited for technical studies may not be involved in it at higher levels, later on.

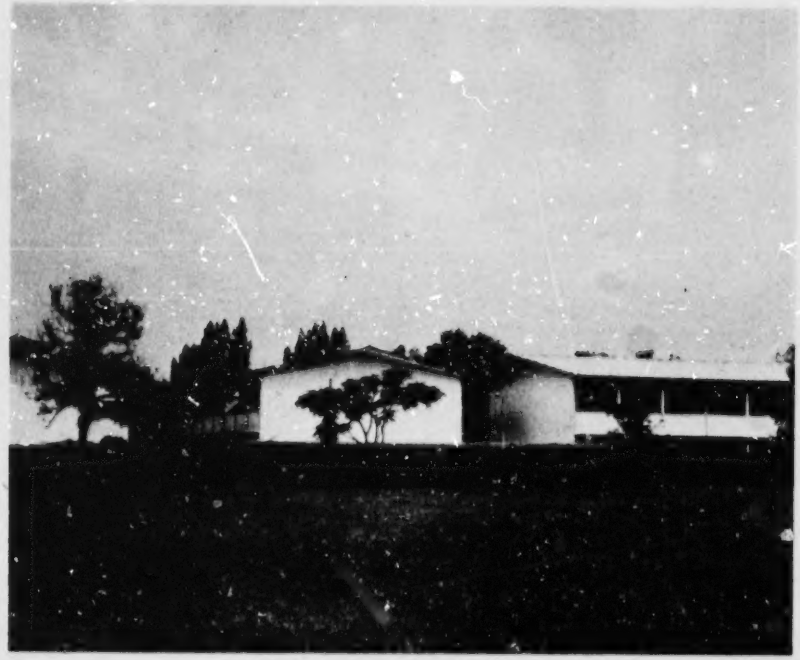

Plate 1 - A large centralized workshop unit with training facilities for a total of 4,800 pupils

Plate 2 - A group of girl pupils at work in a woodwork shop

Plate 3 - A teacher clarifies a point during a woodwork lesson

Plate 4 - Pupils gather around their teacher for a demonstration in basic electricity

Plate 5 - A metalwork teacher demonstrating to his pupils the correct method of filing

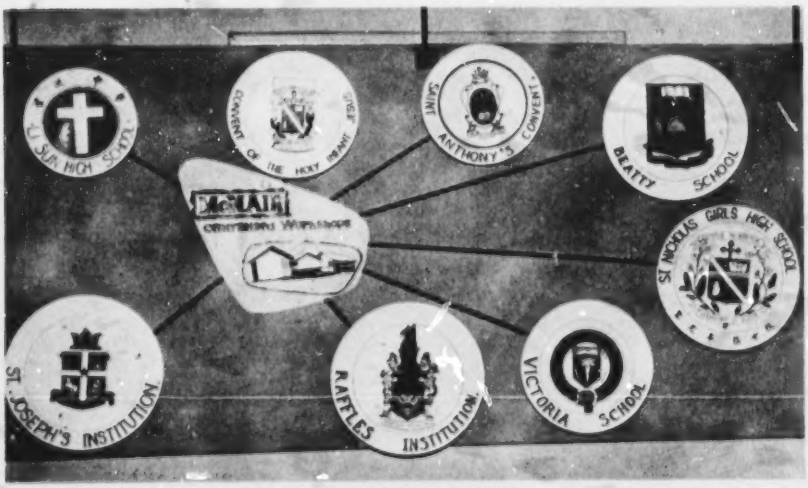

Plate 6 - An illustration of the several academic schools served by a typical centralized workshop unit

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4. Staffing matters

A programme to retrain general education teachers to enable them to teach technical subjects to meet the demand for teachers of technical subjects began in 1968 and has been successfully carried out.[1]

There was a shortage of technical teachers for the newly established centralized workshops. The question arose as to whether to take in fresh recruits or to provide further training in technical subjects to academic teachers already serving, in order to prepare them for teaching in the centralized workshops at Secondary One and Secondary Two grades. Since the preparation of new teachers would have taken a longer time it was decided to begin by the retraining of serving qualified teachers for this task. The above decision rested on the belief that qualified teachers when retrained in technical subjects would be more effective because of the teaching experience they already had. The response to the Ministry's circular inviting general education teachers for retraining was overwhelming. More than 4,000 applications were received from whom only 600 persons were to be selected for in-service training.

Details of the in-service courses run for the purpose of retraining, on a part-time basis, are as follows:

1. August 1968 - 350 English-medium teachers began training;

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1. *Education in Singapore 1972.* p. 62

2. May 1969 - 250 more English-medium teachers began their training;

3. May 1970 - Further retraining of group 1 teachers in another subject;

4. May 1971 - Further retraining of group 2 teachers in another subject;

5. August 1971 - 74 Malay-medium teachers began training as for above groups, with extra lessons in the English language to make them more proficient in English.

Of the six hundred academic teachers who began their training under schemes 1 to 4 above, 460 completed their retraining successfully; 110 of the teachers left the course of their own accord, while 30 teachers were asked to leave due to lack of aptitude and/or poor performance.

The retraining programme was taken in two stages, each being of one year's duration. During the first stage, participants took technical drawing and one subject selected from either metalworking, woodworking or electricity. The second stage, taken a short interval after the first, gave the participants the option of choosing any one of the remaining two subjects. The purpose of providing retraining in two subjects was to achieve greater flexibility in the deployment of staff and at the same time to give the participants an all-round training.

All the teachers applied themselves admirably to the retraining programme although they had to give up three evenings a week to attend training. Teachers who successfully completed the in-service training were eligible for a S$600 bonus payable in instalments of S$150 per annum, provided they taught in the subject retrained for at least fifteen periods per week.

The problems inherent in a rapid expansion of technical education and in the retraining of teachers at short notice were carefully studied. To ensure that there was no lowering of standards, teaching and learning materials were prepared and made available to the centralized workshop teachers. Further help and guidance has been given at their request or when the professional officers at the Ministry felt that it was necessary. The centralized workshops teachers have carried the full weight of the reform and the credit for such success as the project may claim goes to them. It proves once again, if proof were needed, that the most valuable assets in educational innovation are the teacher's creativity, resourcefulness and drive.

5. Achievements of the system

The centralized workshops have served their purpose well. They have successfully coped with the sudden increase in the number of pupils receiving technical instruction in the lower secondary stage. Table 1, below, gives the enrolment of pupils in the technical classes, at least 75 per cent of which was handled by the centralized workshops.

Table 1. Population and pupil enrolment in the lower secondary classes

Year	Total population	Technical classes
1968	69 517	7 504
1969	71 959	36 105
1970	76 095	59 232
1971	79 815	62 237
1972	81 037	62 284

Source: TES Seminar on Technical Education and Industrial Training 1973. *Report*. p.12

With the increase in the capacity of the centralized workshops to handle large numbers of pupils at the lower secondary levels, more pupils were available for channelling into the higher secondary classes. Although available only on a selective basis after Secondary Two, the demand for technical education in these classes (Secondary Three and Four) has grown rapidly, as is evident from Table 2.

Table 2. Population and pupil enrolment in the higher secondary classes

Year	Total population	Technical classes*
1968	61 056	3 770
1969	60 955	4 373
1970	55 850	7 249
1971	61 629	11 942
1972	66 179	14 946

Source: TES Seminar on Technical Education and Industrial Training 1973. *Report*, p.12

* Secondary Three and Four combined.

With larger enrolments in technical classes, the earlier imbalance in favour of purely academic subjects has been corrected and a ratio of 1:3 between the technical and academic stream pupils has been achieved.

The centralized workshop system has helped to increase the pupils' range of options. It allows them the flexibility of remaining in an academic school of their choice while attending technical classes at another school with adequate workshop facilities. The advantages of this arrangement have proved themselves so well that a similar scheme of centralized instruction was extended to the third and fourth years of secondary education in 1973. A Primary Six Orientation Programme based on the centralized workshops was initiated in 1971. It provides the primary school leavers an opportunity to acquire work experience in the workshops and to observe the technical classes in session on an organized basis. In this way it is hoped to increase interest in these pupils towards technical studies.

Initially, the centralized workshops faced a serious problem of absenteeism. This was however soon

corrected when the parents and pupils realized that workshop practice was as essential as studies in other subjects for promotion to Secondary Three or future admission into vocational courses. Nevertheless, applications for exemption from workshop practice have always been considered and deserving pupils excused.

The first batch of pupils under the common curriculum arrangement completed their training in 1972. A number of them have entered the technical institutes. An upward trend in the enrolments of the post-secondary technical institutes is now in evidence.

Table 3. Enrolment in the Post-Secondary Technical Institutes

	1968	1970	1971	1972
* Singapore Polytechnic	3 343	4 094	4 507	5 764
+ Ngee Ann Technical College	356	609	1 209	1 216
@ Singapore Technical Institute	-	272	295	381
@ Vocational Institutes	1 180	2 504	3 061	4 016

Note: * Figures from *Education in Singapore 1972*. p.94

+ March/April enrolments only. Two intakes per year.

@ By courtesy of Industrial Training Board.

The experience of the last five years has vindicated the approach of integrating technical education with general education in the lower secondary level as a means of providing genuine work experiences to the pupils. It has demonstrated that the traditional

prejudice against "soiling one's hands" can be overcome. It underlines the need for thorough planning before an innovation of this nature is launched; for systematic training of personnel and for building up their motivation; for development of appropriate instructional materials; and for continuing review and evaluation.

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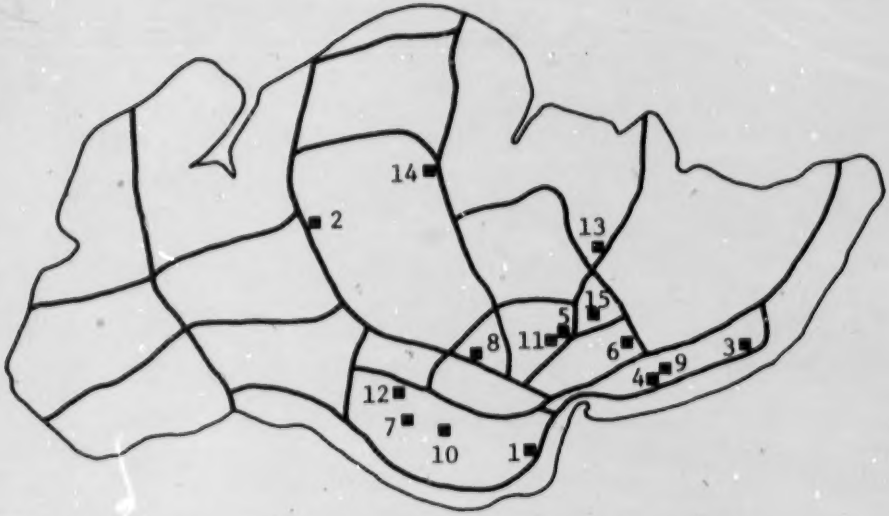
Appendix I

GENERAL LOCATION OF CENTRALIZED WORKSHOP
ADMINISTRATIVE UNITS IN SINGAPORE

SINGAPORE ISLAND



Main Roads ——

LEGEND

1. Anson
2. Bukit Panjang
3. Changi
4. Dunman
5. McNair
6. Paya Lebar
7. Queenstown
8. Swiss Cottage
9. Tanjong Katong
10. Tiong Bahru
11. Toa Payoh
12. Ulu Pandan
13. Upper Serangoon
14. Upper Thomson
15. Yio Chu Kang

Appendix II

Centralized workshop facilities in 1974

Centre name	No. of workshop units	No. of schools served	No. of classes possible	No. of classes actual
1. Anson	1.5+	9	120	95
2. Bukit Panjang	1.0+	4	80	60
3. Changi	1.0+	7	80	82
4. Dunman	1.0+	7	80	67
5. McNair	1.5	11	120	116
6. Paya Lebar	1.0+	7	80	80
7. Queenstown	1.0+	5	80	83
8. Swiss Cottage	1.5	7	120	105
9. Tanjong Katong	1.5	9	120	113
10. Tiong Bahru	1.0	7	80	83
11. Toa Payoh	1.0+	7	80	78
12. Ulu Pandan	1.0+	7	80	66
13. Upper Serangoon	1.0+	7	80	
14. Upper Thomson	1.0	4	80	58
15. Yio Chu Kang	1.0+	6	80	59
Totals	17.0	104*	1 360	1 227

Note: * Due to limited space some schools may be allocated to more than one centralized workshop.

\+ Units include multi-purpose or comprehensive type schools converted into centralized workshops.

Appendix III

SAMPLE SYLLABUS - ELECTRICITY

14 SAFETY DEVICES 14.1 Fuses	To observe the action of an electric current on a fuse. To understand what is the important feature of a fuse, its function. Various types of fuses and the most favourable place for a fuse in a circuit.
14.2 Earthing	To understand what is meant by 'earthing' (or 'grounding') of a circuit. To note the kinds of earthing commonly used.
14.3 Circuit breaker	To understand what is a circuit breaker, how it functions and how it contributes to the safety of a circuit. To note the features of some common circuit breakers (earth leakage and overload).
15 Recognition and uses of electrical accessories	To note the structure of various commonly-used accessories such as switches, lampholders, sockets and plugs and simple fittings (e.g. flourescent lamp), and how they function. Note: Only observations at low voltages may be carried on.

SAMPLE INSTRUCTIONAL SHEETS OR HANDOUTS

(ELECTRICAL)

SUBJECT: SAFETY DEVICES

1. Three reasons for installing safety devices:

   a) To protect circuits against excess current due either to an overload or a short circuit.

   b) To protect circuits against earth leakage.

   c) To allow a qualified electrician to cut off installation from supply.

2. Fuse: A device for opening a circuit (melts when excess current flows through it).

   a) Fuse element - made of aluminium, nickle or alloy of tin and copper, silver, conductor with a low melting point.

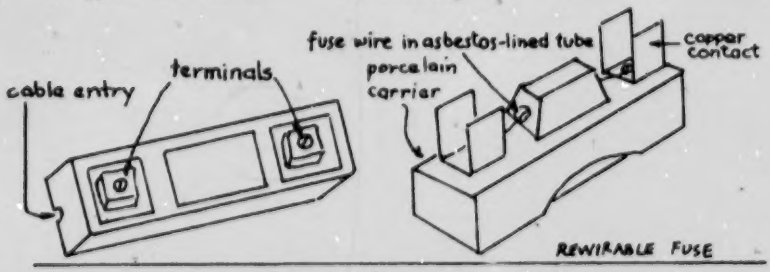
   b) Symbols:

   c) The main fuse protecting the household wiring is always placed on the LIVE wire.

   d) Current rating - the current the fuse element can carry without overheating.

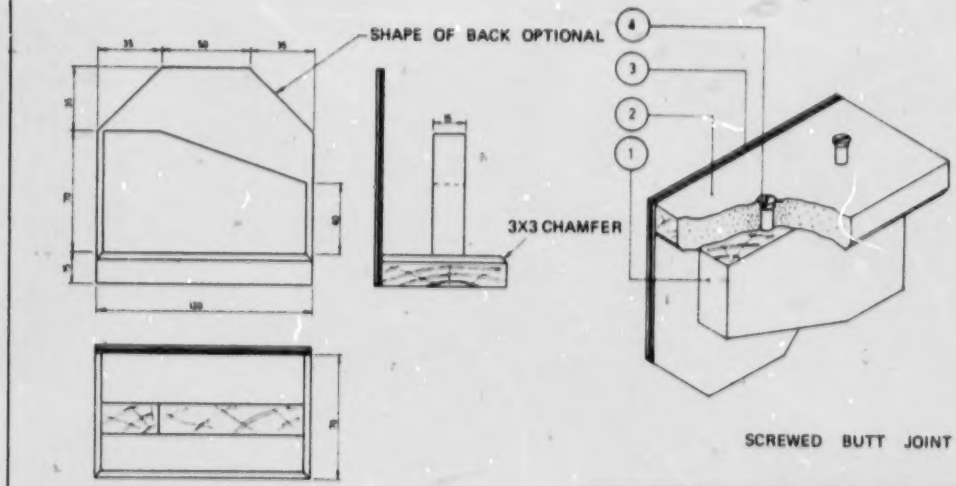
   e) Fusing current - the minimum current that will melt the fuse element.

   f) Types: i) Rewirable ii) Cartridge



SAMPLE TEACHING GUIDE FOR METALWORK TEACHERS

Item No. and topic	Instructional objectives	Learning objectives	Remarks
Basic Tool Kit a) Engineer's ball peen hammer; b) Engineer's files; c) Engineer's try square; d) Steel rule; e) Dividers, odd-leg calipers; f) Dot punch, centre punch; g) Scribers; h) Adjustable hacksaw i) Cold flat chisels	The objective is to generally familiarize the pupils with the basic tools they are most likely to use during their workshop practice. To teach pupils: i) to recognize the basic tools; ii) to select tools correctly for use; iii) to use the check list in the metal workshop tool rack or drawer	Pupils should be able to recognize the basic metal working tools and be aware of their organization in the workshop.	Actual tools must be shown to the pupils and their principal features pointed out to them. Show the pupils the use of the check list on the metal work bench. Show pupils charts of these tools, if necessary, and briefly demonstrate the correct method of handling and caring for these tools.



SCREWED BUTT JOINT

ALL DIMENSIONS IN MILLIMETRES

TECHNICAL EDUCATION DEPARTMENT			
WP 1/2	LETTER RACK		
NO.	DESCRIPTION	MATERIAL	NO. OFF
1	MEMBER	DRM	1
2	BASE	DRM	1
3	BACK	PLYWOOD 5mm	1
4	SCREW	MS 31 X 6G	2

SAMPLE PROJECT SHEET

Appendix VI-A

Appendix VI-B

SAMPLE OPERATIONS SEQUENCE SHEET

Sequence of operations	Methods
1. Prepare material to size.	a) Check material with the cutting list. Test the two planed surfaces for flatness and squareness. Mark face side and edge. Gauge and plane the material to the true size.
2. Mark out the parts as shown.	b) Mark out lengths of parts. Square round with cut lines and mark the waste parts.
	c) Mark the two housings on Part 2, scribe the cut lines with the marking knife. Note: Width of housing is equal to thickness of material. Mark the bevels with the pencil.
	d) Locate and mark the centres of holes on Parts 1-a and 1-b at the same time. Check the setting out carefully.
3. Separate parts and check.	e) Always saw on the waste side of the marking line. Plane all end grains and check width of housings.
4. Cut housings.	f) Saw the walls of housings 9mm deep up to gauged lines. Chisel out the waste carefully until it is flat and level.

5. Make trial assembly of joints.	g) Check fitting of joints. Make slight adjustments if necessary.
6. Bore holes on Parts 1-a and 1-b.	h) Clamp the parts together and bore the holes as shown. On Part 1-a, saw across the centre line of holes to obtain shape.
7. Cut bevels.	i) Saw near the marking lines and plane to lines. Check for squareness.
8. Clean up all parts and assemble.	j) Clean up carefully with smoothing plane and assemble the joints with glue and nails. Shoot off high spots.
9. Finish.	k) Finish with oil and wax or with shellac.

Appendix VI-C

SAMPLE MARKING SCHEME

Mark Sheet

Woodwork project WP 1/2 Letter rack	Fin. Length - Pt. 2 - 120 mm	Fin. Width - Pt. 2 - 70 mm	Fin. Max. Length Pt. 1	Fin. Min. Length Pt. 1	Bevel on Pt. 1	Positioning of Pt. 1	Screwing	Square of sides (Pt. 3)	Shaping on Pt. 3	Finish (bare)	Finish (treated)	Raw marks	Adjusted marks and total
No. Name Marks	2	2	2	2	3	2	3	3	3	5	3	30	20
1.													
2.													
3.													
4.													
5.													
6.													
7.													
8.													
9.													
10.													
11.													
12.													

* Use Assessment Grading Scheme (Subjective considerations)

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SAMPLE THEORY TEST FOR ELECTRICITY

1. The three Safety Devices commonly used are:
   a) _____ b) _____ c) _____
2. The reasons for installing safety devices are:
   a) To protect circuits against _____ current.
   b) To protect against _____ leakage.
   c) To allow a qualified electrician to cut off installation from _____.
3. A _____ consists of a short piece of wire with a low melting point.
4. _____ is a device for making and remaking a circuit under normal and abnormal conditions.
5. Draw the symbol of an 'earth': (or 'ground' in other terminology):
6. The main fuse protecting the household wiring is always placed in the _____ wire.
7. The two types of fuses are:
   a) _____ b) _____
8. Draw the symbol of a fuse:
9. Earthing (or grounding) is a means of:
   a) Preventing electrical _____.
   b) Preventing fire _____
10. The international colour code used in connecting the three-pin plug: Live _____ Neutral _____ Earth (or ground) _____.
11. Current rating is the current the fuse element can carry without _____.
12. Fuse current is the _____.

OE 608 338

Appendix VIII

RESPONSIBILITIES OF CENTRALIZED WORKSHOP STAFF

Supervisor : Overall responsibility for the organization and administration of the centralized workshop.

Senior Assistant : Assists the supervisor in the day-to-day administration and is responsible for security, safety and discipline in the workshops.

Senior subject teacher : Responsible for supervising and advising teachers on the professional aspects - schemes of work, teaching materials, assessments - relating to the effectiveness of the specialization or discipline involved.

Teachers : Responsible for the upkeep and general maintenance of their respective workshops and carrying out of teaching and extra-curricular activities.

Note: A single centralized workshop unit catering for an intake of 80 classes or 3,200 pupils would have a maximum of 1 supervisor, 1 senior assistant, 4 senior subject teachers and 30 teachers, eight of whom would be assigned duties as workshop heads.